UT Forum 21

The University of Tokyo Magazine

UT Forum 21 aims at sharing worldwide the latest developments at UT with everyone interested in education and research.

January 2001

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THE UNIVERSITY OF TOKYO

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UT Forum 21

No. 1, January 2001

C O N T E N T S

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Throughout this magazine, the names of Japanese persons are presented in the order, given name followed by family name.

Greetings from the Editor

At the turn of the new century, it is our great pleasure to publish an English magazine, *UT Forum 21*. Since 1877, when the University of Tokyo was founded as the first national university in Japan, it has continuously expanded and reformed its structure to adapt to the development of higher education and research while coping with various problems and demands from time to time. As a research-oriented university, the present-day UT, which consists of thirteen graduate schools, ten faculties, eleven institutes and twenty-four research centers in a wide range of disciplines, holds a high position in research and education on an international standard.

Information now instantaneously moves around the world, and this will be accelerated in this new century. Out-flow of information from UT in English is, without doubt, indispensable for the staff and students to survive while cooperating with, and mutually stimulating, colleagues in a world academic community. This new magazine is aiming at sharing worldwide the histories of UT and the latest development at UT with everyone interested in education and research.

I appreciate very much the support and cooperation of readers, given to the editorial board of *UT Forum 21*, which will be published annually to contribute to the development of academic activities in an atmosphere of international reciprocity.

Ryutaro Ohtsuka, D.Sc.
Director, the Committee of Public Relations

SHIGEHIKO HASUMI

In April 1997, Shigehiko Hasumi took office as the twenty-sixth president of the University of Tokyo. Graduating from the University of Tokyo's program in French literature in 1960 and receiving a doctorate from the University of Paris in 1965, he joined the University of Tokyo in 1970 as an associate professor in the College of Arts and Sciences and was promoted to full professor in 1988. He served from 1993 to 1995 as Dean of the same college and from 1995 to 1997 as Vice-president of the University of Tokyo.

Welcome to the University of Tokyo

What comes to mind when you think about the campuses of the University of Tokyo? You will probably recall first the Hongo Campus, and you may have fond memories of our Komaba Campus as well. But we also have many other locations. The Institute for Cosmic Ray Research's huge Kamioka Observatory in Gifu Prefecture will not be forgotten by people who have been there, and those who have sailed the Pacific on board the Ocean Research Institute's Hakuho-maru will recall the productive time they spent on that research ship. The University of Tokyo thus reaches far beyond Tokyo itself, from the University Forest in Hokkaido in the north to the Amami Laboratory of Injurious Animals on Amami-oshima in the south. We are proud of the contributions that these facilities have made to your studies and research, and we hope that you will visit them again.

After the new University of Tokyo was reborn in the wake of the Second World War, we were fortunate to be able to grow and develop on the Hongo and Komaba Campuses. Now I am honored to be the President of the University as we begin building our third campus on over twenty hectares of land in Kashiwa City, Chiba Prefecture. New facilities are nearly complete there for the Institute for Cosmic Ray Research, which has moved to Kashiwa from Tanashi, and the Institute for Solid State Physics, which has moved there from Roppongi. Buildings are also under construction for the new Graduate School of Frontier Sciences, which brings together our university's wisdom and learning in many fields, and in a few years this entire graduate school will have moved to the new campus. At Komaba, we have also nearly finished a new building for the Institute of Industrial Science, which will be moved there from Roppongi, and at Hongo construction is moving ahead quickly on a new research building for the Graduate School of Medicine and new wards for the University Hospital. If you have not visited the University of Tokyo in a while, you will be amazed at all the changes on our campuses.

Many visitors from overseas ask how we are able to carry out such ambitious construction projects if Japan's economy is so weak and the university's budget is so restricted. The answer is simple. For the past several decades, we have carefully developed an ambitious vision for the university focused on the twenty-first century. The strength of that vision has already been demonstrated by our widely recognized achievements in both education and research. The physical innovations visible on our campuses reflect the commitment to internal innovation by everyone involved in education and research at our university. That commitment has been stimulated and strengthened by the people from throughout the world who have spent time here, whether for short visits or longer stays, and we are very grateful for their contributions. If you have been to the university before, please come and visit us again, not only at the campuses that you remember but also at our new Kashiwa Campus. And if you have never been to the university, we look forward to welcoming you. The University of Tokyo is open to all people who are sincerely committed to education and research.

The University of Tokyo is open to all people who are sincerely committed to education and research.

Shigehiko Hasumi, Ph.D.
President

UT: Its Origin and History

Foundation of the University of Tokyo

The University of Tokyo was founded in April 1877, as the first national university in Japan (fig. 1). It had its origins in two schools some twenty years earlier, the Institute for the Investigation of Western Writings called *Bansho-Shirabesho* (set up by the Tokugawa Shogunate), founded in 1856 to import and study Western books on technical subjects and to translate diplomatic notes, and the Vaccination Center (*Shutosho*), a private facility of Western medicine initially founded as a smallpox vaccination clinic in 1858. The large-scale opening ceremony of the university's immediate predecessor, the Tokyo Kaisei Gakko, was attended by the Emperor, Japanese and foreign dignitaries and prominent officials (fig. 2). The university was renamed Tokyo Imperial University in 1886 and was the only such university in the country until 1897. As such it played a central role in academic research and education.


fig.1


fig.3

Research and Education

From the time of its founding, the University of Tokyo was a special educational institution, comprising the four departments of law, science, literature and medicine. It also taught engineering (fig. 3) and agriculture. In this sense it varied somewhat from other universities around the world. Foreign teachers were a major element in the teaching of special subjects during the early period of the university (fig. 4). Besides contributing their experience, they also acted to introduce Japan to the West (fig. 5). European languages were no longer used as languages of instruction after the 1880s but their importance continued. The library began acquiring Western academic and technical works from very early in the university's history (fig. 6).


fig.4*

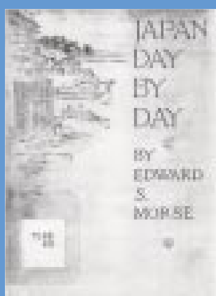


fig.5

Historical Remains and Buildings

Hongo, the main campus of the university, situated in Bunkyo Ward, Tokyo, occupies the site of the estate of a feudal lord of the Tokugawa Period (1600–1867). Still intact from that time are the Akamon (Red Gate, fig. 7) and Sanshiro Pond. Before the Kanto Earthquake of 1923, the buildings were mainly of brick in a variety of architectural designs (fig. 8). Only two or three buildings remain from that period. After the earthquake, buildings were erected according to the campus plan devised by the professor of architecture, Yoshikazu Uchida. The style of his buildings, called


fig.7


fig.8


fig.2

*fig. 4: Owned by Dept. Electrical Eng./ Dept. Information and Communication Eng./ Dept. Electronic Eng, Graduate School of Engineering.


fig.6

scratch tile gothic, brought architectural unity to the Hongo Campus.

Centroid of a Tripolar Structure

In June 1992 the university decided on the "Outline of the University of Tokyo Campus Plan," formulated around a tripolar structure concept centering on the Hongo, Komaba and Kashiwa Campuses. According to this concept, the Hongo Campus will be concerned with traditional forms of education and research (the disciplines), the Komaba Campus with new developments in the first two years of undergraduate studies and with advanced research, and the Kashiwa Campus with education and research through a new academic domain. It is planned that the Kashiwa Campus will contain the Graduate School of Frontier Sciences, the Institute for Solid State Physics and the Institute for Cosmic Ray Research, together with more institutes and research centers, and that it will become a touchstone for the new challenges that the university is taking up. Student festivals at the Komaba and Hongo campuses are open to the public (fig. 9).

fig.9

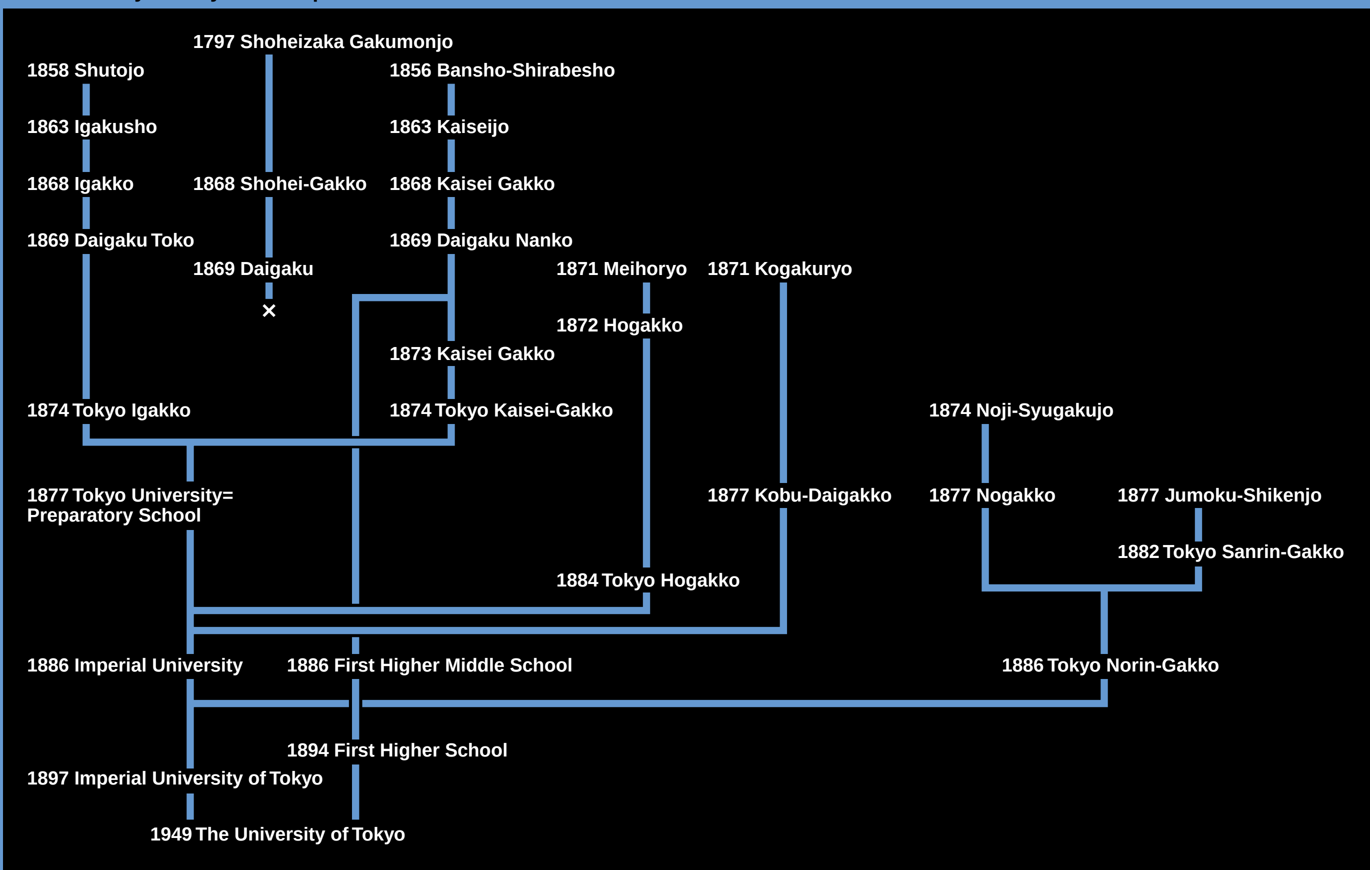
Entrance, Graduation and the Open Campus

Japan is known for the stiff competition that applies to university entrance examinations, and the University of Tokyo is reputed to be one of the hardest universities to enter. An entrance ceremony is held every year for all new undergraduates (fig. 10). Graduation has traditionally been a time of great rejoicing for the graduate, but also of great significance to the nation. Since the university was founded in the 1870s, its graduates have given their talents to the nation. Thus the graduation ceremony was a time of congratulation for the country as well as the individual.

In July 2000 Open Campus was held for the first time and a large number of high school students took part. This experience, it is hoped, will encourage students to choose to apply to the University of Tokyo.

fig.10

The University of Tokyo and its predecessors



Academic Performance Abroad

UT Forum 2000 in Boston

Japanese universities have long been hesitant to take their place upon the international stage. As an institution as a whole, they have not publicized the research results of their staff abroad. Yet staff of the University of Tokyo have read papers, very often, at international scientific conferences, and in terms of articles published in internationally recognized academic journals, the university occupies a leading position in the world.


Tadao Ando


Reiko Kuroda


Hiroyuki Yoshikawa


Makoto Asashima


Masatoshi Koshiba


Yoichiro Kawaguchi


Nobutaka Hirokawa

UT Forum was set up at the instigation of Dr. Shigehiko Hasumi, the President of the University of Tokyo (UT), who is convinced that it is time that the hesitancy of the past be done away with. "This forum is the first step in placing UT on the world map," he said. It is perfectly natural that staff of UT should discuss their results directly in their own voices with scholars and students abroad.

Supporters

The forum was brought to fruition within a short time after the president's decision. This was due to the help and cooperation of a great many individuals and organizations from both within and outside the university. When the hope was voiced to hold the forum in Boston, it was the warm support of the Massachusetts Institute of Technology (MIT) and its president, Dr. Charles Vest, that was indispensable in bringing the project to realization.

The Nobel Prize winner Professor Susumu Tonegawa of MIT also gave his enthusiastic support, encouraging us and sharing his wisdom with us. The Japan Society for the Promotion of Science (JSPS) also agreed to act as a joint sponsor. Dr. Hiroyuki Yoshikawa, former president of the University of Tokyo and presently chairman of JSPS, was a leading spirit in the forum, to the extent that he even gave a paper at it.

"Nebular 2000" Image
by Yoichiro Kawaguchi

These scholars were introduced by their respective mentors or friends, Nobel Prize winners and leading scholars who were delighted to act as chairs.

It was the warm support of the Massachusetts Institute of Technology and its president, that was indispensable in bringing the project to realization.

Presenters and Chairs

The program was formulated in the vibrant atmosphere engendered by President Hasumi's initiative. Presenters were selected from teaching staff and emeritus professors of the university, chiefly in the fields of the natural sciences.

Biology is a field that is currently undergoing a great revolution. Three biologists were chosen to present papers: Professor Nobutaka Hirokawa, a cell biologist from the Graduate School of Medicine, Professor Makoto Asashima, a developmental biologist from the Graduate School of Arts and Sciences, and a structural biochemist, Professor Reiko Kuroda, also of the Graduate School of Arts and Sciences. All three are leading scholars internationally in their fields, and are also closely involved with undergraduate/graduate teaching.

From the field of physics, Emeritus Professor Masatoshi Koshiba, famous as the father of neutrino research, readily gave his consent to appearing as a presenter at the forum. The diverse field of engineering was represented by the architect Professor Tadao Ando of the Graduate School of Engineering, renowned throughout the world for his unique ideas concerning city planning and building planning; by Professor Yoichiro Kawaguchi of the Research into Artifacts Center for Engineering who has opened up new realms in computer graphics, fusing engineering and the arts; and by Dr. Hiroyuki Yoshikawa, who has revised the paradigm of engineering scholarship in the fields of design planning and robotics.

These scholars were introduced by their respective mentors or friends, Nobel Prize winners and leading scholars who were delighted to act as chairs.

The Day of the Forum

On January 24, 2000, the snow that had been falling until the previous day miraculously stopped. For thirty minutes prior to the official start at 1 p.m., Professor Kawaguchi's computer graphics were shown on a giant screen in the Wong Auditorium of MIT. Gradually the seats filled.

Following a short introduction, President Vest of MIT welcomed everyone to the forum. President Hasumi then talked about UT and the aims of the forum.

The first session was for scientific presentations. The chair for the first two papers, Professor Marc W. Kirschner of Harvard Medical School, introduced Professor Hirokawa. The auditorium hushed as Hirokawa began his lecture. Professor Asashima followed with his paper. Next, Professor Tonegawa of MIT greeted the audience, and then Professor Kuroda, introduced by Professor Koji Nakanishi of Columbia University, and Professor Koshiba, introduced by Professor Sheldon L. Glashow of Harvard University, gave their presentations.

After a break, the second session, technological and artistic presentations, opened. The theme moved from the profound spirit of inquiry of science to the fascination of creation. Dr. Yoshikawa, introduced by President Hasumi, Professor Ando, introduced by Professor Tonegawa, and Professor Kawaguchi, introduced by Professor Marvin Minsky of MIT, each spoke of their ideas and the results of their studies. The second session was marked by a feeling of enjoyment and relaxation, mostly because the audience had entered into the spirit of the forum.

The first session was scientific presentations and the second session was technological and artistic presentations.

Lingering Memories

Presentation of the reports finished on a high note and light refreshments were served in an adjoining area. People crowded around and formed groups surrounding the speakers. Their excitement bespoke the success of the forum.

At the official reception party which began at 8 p.m., President Hasumi smilingly recounted to the audience the wonderful achievements of the forum. Greetings were then given by Mr. Alexander D'Arbeloff, Chairman of the MIT Corporation, and by Professor Andrew Gordon, Director of the Edwin O. Reischauer Institute of Japanese Studies. At the height of the party, a traditional Japanese ceremony called "Kagamiwari," opening a huge sake (Japanese wine) cask with mallets, was performed by these people, to great enthusiasm. The after-dinner speech was given by Professor Samuel C. Ting of MIT, drawing the evening to a close.

Later Comments

All presenters spoke of their excitement to be at the forum. "The question of what architecture is has always been a pressing question," said Professor Ando. "I wanted to talk about what an architect can do in terms of its definition." He added, "I was encouraged that Professor Tonegawa, a friend of many years standing, was kind enough to introduce me." Professor Asashima commented, "Unique research into the formation of the organs of living beings which developed in Japan may sound uncouth but it is of fundamental importance. I wanted to tell people about this and about how ultimately it might be applied to human beings… I attempted to explain my work plainly for the sake of young people and the general public."

"Kagamiwari" performed by President Shigehiko Hasumi (left) and four distinguished guests.

Professor Ando was truly glad that frank communication had been brought about between people of such different living environments, value systems and cultural backgrounds as the United States and Japan. "I spoke about town planning in Kobe after the 1995 earthquake there and was greatly stimulated by the sincere and searching questions afterwards, particularly those from the young … I would really like young people in Japan to be more positive in this aspect." For two days after the end of the forum, Professor Asashima gave four lectures at Harvard University and other places at the invitation of Professor Kirschner and others. "Japanese young people have a great ability to absorb knowledge … however, young Americans are filled with a spirit of adventure, and are not afraid to make mistakes," observed Professor Asashima. "My experience here has been useful not just for my future research but for my work as a teacher as well."

The impressions of President Hasumi and all UT members who took part in the forum are encapsulated in the words of these two professors.

(Yasunari Takada, Professor, Graduate School of Arts and Sciences, and Ryutaro Ohtsuka, Professor, Graduate School of Medicine)

"My experience here has been useful not just for my future research but for my work as a teacher as well."

Nobutaka Hirokawa:
"How Do the Cells Transport Organelles and Protein Complexes?"

Makoto Asashima:
"In Vitro Control of Organogenesis and Gene Expressions in Animal Development"

Reiko Kuroda:
"Chirality and Achirality in Molecular Processes"

Masatoshi Koshiba:
"Observational Neutrino Astrophysics"

Hiroyuki Yoshikawa:
"Design—Artifacts—Environment"

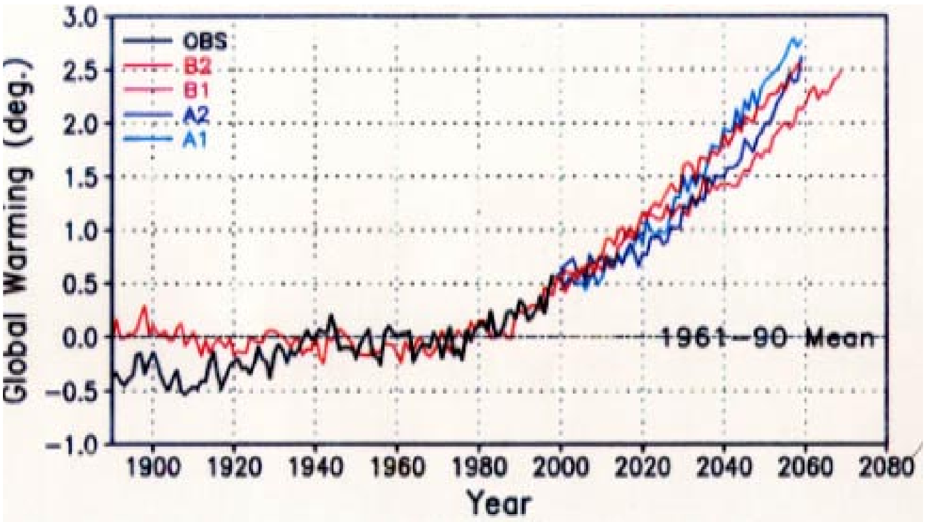
Tadao Ando:
"From Architecture to Cities: Aiming for Public Spaces"

Yoichiro Kawaguchi:
"Life—Survival—Art"

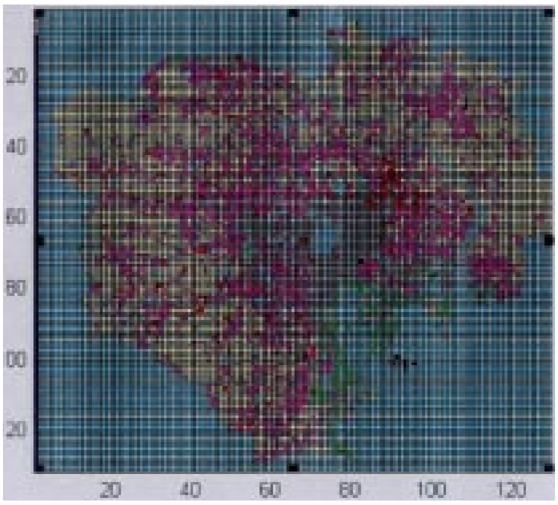
Sustainability Pays Dividends
UT is Active in AGS

The Alliance for Global Sustainability (AGS) is a project which was set up in the autumn of 1996 through a formal agreement for academic cooperation concluded by the Swiss Federal Institutes of Technology (ETH), the Massachusetts Institute of Technology (MIT) and the University of Tokyo (UT). This joint research project will seek specific ways of protecting the global environment and of creating a sustainable culture.

Under the umbrella of the AGS, there are twenty-seven research projects being undertaken in 1999–2000, with over one hundred UT staff members participating. In addition there are a large number of post-doctoral fellows and postgraduates involved, from a great many disciplines such as science, engineering, agriculture, medicine, law, and economics. In broad terms, the research projects can be classified into use and management of resources, environmental effects on health, urban systems, the process of food production, environmental policy, and cooperation with developing countries. Four project leaders talked about their standpoints and goals of research.



Simulation experiments for global warming by the Center for Climate System Research of the University of Tokyo and the National Institute for Environmental Studies.



Example of output of building information in Tokyo, using the geographical information system.

Chong Qing city under heavy air pollution.

Global Climatic Change

Professor Akimasa Sumi, *Center for Climate System Research*

As the hot summers continue, many people tend to think of global warming. The climate model that we are using attempts to take into account the unbelievably large shocks that nature can give us to predict scientifically the progress of global warming, and estimate whether it has been caused by human activity and what its effects on food production will be.

Tokyo Greenhouse Gas Half Project

Professor Keisuke Hanaki, *Graduate School of Engineering*

Our first aim is to devise a strategy to halve the emission of carbon dioxide in Tokyo. We are making a comprehensive analysis of the environment of buildings in which people spend much of their time, of urban transportation systems and of human activities in the city. The results of this study will be applied to Guangzhou in China, which is experiencing rapid industrialization and urbanization.

Arsenic Contamination in Bangladesh

Professor Ryutaro Ohtsuka, *Graduate School of Medicine*

In Bangladesh, as a result of the tube wells dug through international aid to avoid the bacterial infection rife in the country, naturally occurring arsenic in the underground water has adulterated the well water. The population at risk of poisoning is more than 35 million. Arsenic poisoning begins as a skin manifestation, then progresses to skin cancer and internal organ cancer. Little is known about the progress to arsenicosis or how it can be combated. We are investigating how to prevent arsenicosis and what kind of water supply system is most suitable.

Making the Use of Coal Clean in China

Professor Hideaki Shiroyama, *Graduate School of Law and Politics*

About 75% of the energy used in China is supplied by coal. The emission of carbon dioxide and sulfur oxides gives rise to environmental problems such as acid rain and global warming. An important issue is whether coal can continue to be used efficiently and cleanly. Our project is not only looking at low-cost technical options but is attempting to clarify the political, economic and administrative conditions regarding their acceptance and diffusion in Chinese society.

The History and the Spirit of AGS

Formal signing of the agreement to set up AGS by the three universities, which took place at UT in 1996, was the culmination of meetings held at MIT in 1994 and at ETH in 1995. In 1996, Dr. Hiroyuki Yoshikawa, the then president of UT, spoke at the conference. “Many contemporary environmental problems,” he said, “have arisen directly from human activities, and we have to ask ourselves how we are to deal with this enemy within. It is a fact of present reality that traditional academic disciplines which were developed to confront the enemy without cannot cope with the enemy within. We need to restructure the disciplines.”

This joint research project was undertaken at the initiative of the presidents of the three universities, in agreement with this viewpoint. In 1997 Dr. Shigehiko Hasumi succeeded Dr. Yoshikawa as the president of UT, and under him the spirit of AGS has continued unchanged as work continues to widen research fields, to increase the number of scholars involved and to bring their results into society as a whole.

Funding for the projects has come largely from Dr. S. Schmidheiny through the Swiss Foundation AVINA, but the universities concerned and the researchers have also contributed to raising the necessary funds.

Every year a conference is hosted by each university in turn. The 2000 conference, held at MIT, was attended by close to one hundred people from UT, not just teaching staff and graduate students but also undergraduates from all the various faculties.

Traditional academic disciplines which were developed to confront the enemy without cannot cope with the enemy within.

A Japanese team member measures the arsenic concentration of well water in a rural village of Bangladesh.

Desired Outcomes

Four project leaders explained the up-to-date findings and the scope of future work.

Global Climatic Change

According to a prediction based on a climate model that increases the annual rate of the concentration of carbon dioxide in the atmosphere by one percent and running a supercomputer for several months, temperature rises in the high latitudes and continental regions and the distribution of the amount of running water also changes. If this occurs, there is a strong possibility that the productivity of wheat will fall and there will be a strain on supply and demand, while the productivity of rice in Asia will rise. Central issues relating to warming include the effect of food productivity on politics and economics and changes in the local water cycle and land use. To improve the present climate model and to make predictions of a higher reliability is certainly a goal of the AGS project.

Tokyo Greenhouse Gas Half Project

The chief measures to be undertaken are to convert the energy supply to one which is able to contain the emission of carbon dioxide more, to reduce the amount of energy consumed, and to change urban structure. These are the desired outcomes. In order to make a general evaluation of complicated and interdependent factors, such as reducing the rate of carbon dioxide emission by increasing the efficiency of electricity generation, and reducing the amount of electricity consumed, a tool called DOME (distributed object-oriented modeling environment) is being used at MIT. By making models for the various objectives, linking them to DOME, and using the internet, both MIT and ETH are conducting real-time exchanges to come up with a way to reduce carbon dioxide emission by half.

Arsenic Contamination in Bangladesh

Painstaking surveys have been conducted since 1997 in two villages in the Nawabganj district, where patients were first discovered. Samples have been taken of water from more than a hundred wells and of urine from all the residents, skin manifestations have been examined by specialists, interviews have been conducted to ascertain the consciousness of the population regarding arsenic contamination, and there has been analysis of samples in the laboratory. The dose-response relationship between the amount of arsenic in well water and that in urine has been made clear. Not only has it been shown that skin manifestations are related to the degree of arsenic in the urine, but it has also become clear that the seriousness of symptoms is connected with nutritional status and that skin manifestations in males are worse than those in females. A high frequency of skin manifestations has also been noticed in children of school age. The low-cost removal of arsenic from water has been entrusted to scientists of ETH, while researchers of MIT are responsible for analyzing the dynamics of arsenic in underground water, including boring in various spots. This project, which also involves scientists in Bangladesh, is a new challenge being met in the name of environmental sustainability.

Making the Use of Coal Clean in China

As a result of a study of the various political, social and administrative conditions in Chinese society concerning the employment and diffusion of technical options, such as improving the efficiency of boilers used in industry and simple extraction equipment, four factors have been revealed as being of particular importance. The first is that the energy market is incomplete and that the price of coal energy has been kept low. Second, environmental regulations are not sufficiently enforced and it has been difficult to give industry incentives to get rid of sulfur dioxide. Third, the currency crisis occurring at a time of a changing economy makes it difficult to invest in industrial environmental measures. Lastly, international NGOs are negative about the clean use of coal in China. It is the task of the social sciences concerned with environmental issues to overcome such political, economic and administrative barriers and develop a plan to stimulate the formation of mutual agreement.

(Shuichiro Asao, AGS Coordinator in UT)

Bangladeshi children meet the researchers.

The spirit of AGS has continued unchanged as work continues to widen research fields, to increase the number of scholars involved and to bring their results into society as a whole.

Alliance for Global Sustainability 2001 Annual Meeting, Lausanne, Switzerland January 14–17, 2001 Draft Agenda

Working Title: Shaping the Future: Tools for Sustainable Development

The working title reflects the overarching theme of the meeting. Panels and workshops will aim to articulate major problems in specific sectors, and identify strategies, methods, and technologies for sustainable development, with a focus on emerging results of AGS-supported research. The aim is to demonstrate the strong linkage that must be made between science and decision-making at all levels if we are to progress toward sustainable development.

The meeting will address these themes in a problem-oriented manner, beginning with the problems decision makers are facing and then looking at the methods which can help to identify and solve these problems.

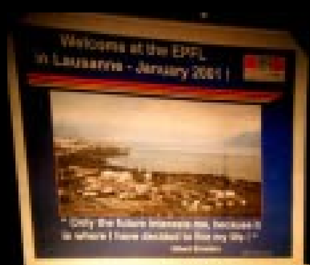
Main issue-themes to be addressed:

1. Managing Megacities – The Urban/Global Link: What are the major challenges of the world's burgeoning mega-cities? What is the link between urban pollution and global environmental threats? What are the differences – and similarities-between mega-cities in the developed and developing world? How can we manage the metabolism of megacities, and satisfy societal needs with a minimum of energy and material flows?

2. Emerging Technologies – Criteria for Change: How can we cope with rapidly evolving technologies? How can we get from an embedded infrastructure for meeting societies' needs to infrastructure and supporting technologies that are more sustainable? What is the time perspective on long term goals in a short term economy? What is the role of information technologies?

3. Food and Water for the Future: What are the available/necessary tools to address major challenges in water and food production? What are the constraints to meeting global demand for clean fresh water? Are the major challenges environmental? Institutional? Political? What are the solutions to worldwide soil salinization?

4. A Future for the Climate: Given the science, what can we say about the timing of responses to the challenge of climate change? Why is Kyoto not working? Reducing CO_2 emissions by efficiency improvements, fuel switching, decarbonization, renewables, demand side management?



Kashiwa Campus
Meeting a New Challenge

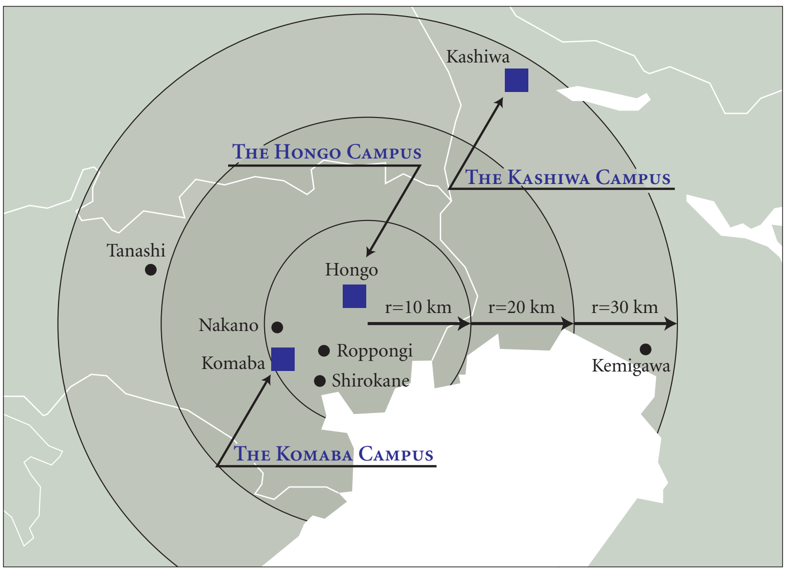
Kashiwa is being developed as the third campus after Hongo and Komaba. Here we introduce you to the new campus, where buildings are now being erected at a rapid pace, a striking contrast with the traditional nature of the other two campuses.

Kashiwa is the third of the University of Tokyo's campuses (the other two are at Hongo and Komaba) and it has been built to support a broad range of academic disciplines. It is located outside the metropolitan area some fifty minutes by express train and bus from Ueno, in central Tokyo. It comprises a graduate school and research facilities; undergraduates are not taught there. In the future various research centers are planned to move there. As of the academic year 1999–2000, a building to house two research institutes (the Institute for Solid State Physics and the Institute for Cosmic Ray Research) was constructed, together with a part of one graduate school (Frontier Sciences). The academic fields covered in the Kashiwa Campus are all concerned with problems that modern society needs solved: issues concerning such areas as material, energy, information, complex science, life, the properties of material, and cosmic rays. The Kashiwa Campus is intended to be a national center for education and research in leading-edge scientific fields.

The Graduate School of Frontier Sciences is an independent graduate school established in 1998, which is aimed at solving complex problems from an interdisciplinary viewpoint and at setting up new academic disciplines. It comprises six specialty departments: Advanced Materials Science, Advanced Energy and Engineering, Frontier Informatics, Complexity Science and Engineering, Integrated Biosciences, and Environmental Studies.

The Institute for Solid State Physics is a facility founded in 1957 for use by the nation as a whole, for both the experimental and theoretical study of the properties of matter. It is made up of five departments dealing with New Materials Science, Condensed Matter Theory, Frontier Areas Research, Physics in Extreme Conditions, and the Advanced Spectroscopy Laboratory. The Institute for Cosmic Ray Research is also open to all scholars in Japan, founded in 1976

Map of the Distribution of the University of Tokyo (within a 30 km Radius of Central Tokyo)



out of the restructuring of the Cosmic Ray Observatory. It observes and conducts research into neutrinos and other cosmic rays. A number of other research centers are planned to assist the structure of next-generation general scientific research and it is intended that these too will positively advance efforts to pioneer new academic disciplines. Basic facilities and a branch of the university libraries are also planned for each area of research.

On the southern edge of the Kashiwa Campus is the Kashiwanoha Park, and nearby are located the Tokatsu Techno Plaza, the center of Chiba Prefecture's efforts to promote industry and education, the Chiba Prefectural Plaza, which hosts a variety of events and also public lectures aimed at lifetime education, the stadium of the Kashiwa Reisol soccer team, and the Eastern Hospital of the National Cancer Center, known for its advanced medical facilities, including a hospice. A research park is also planned to promote developmental research linked with new-generation industrialization. It is anticipated that the Kashiwa Campus will quickly become the center for this hub of regional development. It is hoped too that, with its aspirations for the future and academic flexibility, the campus will become a base from which information will be sent throughout the world and a new intellectual adventure will begin.

Science Academia

Twenty-one young students from junior and senior high schools in the Chiba and Tokyo areas attended the Satellite School 2000 for Future Scientists at the Institute for Solid State Physics (ISSP), the University of Tokyo, Kashiwa campus on July 24th and 25th, 2000. This School was held as a joint activity between the ISSP and Chiba Prefecture, as part of a series of lectures for high school students held in various research institutes in the prefecture. The aim of the school was to give opportunities for motivated students to experience the atmosphere of the most advanced laboratories in the University of Tokyo. Six professors from the ISSP prepared introductory lectures and simple experiments on the following topics:

Materials science and supercomputers
Ultra low temperature physics
Physics of ultra high magnetic fields
Lasers: coherent light
Materials synthesis: search for new materials
Microfabrication

We hope that many more future scientists will participate in the next School planned for March 2001.

High school students doing experiments to study properties of superconductivity, the phenomena of conductance without loss which occurs in some metals at low temperatures.

Hideo Kuroda
Historiographical Institute

Hisaki Matsuura
Graduate School of Arts and Sciences

Kenjiro Miyano
Graduate School of Engineering

Tomoko M. Nakanishi
Graduate School of Agricultural and Life Sciences

PEOPLE in UT

The University of Tokyo has more than 4,000 research staff, all working to break new ground in the pursuit of their goals. We introduce eight of them here, world-class scholars in a number of diverse fields, hoping that their achievements and personalities will show the varied nature as well as the excellent results of the research being done at UT. They have been chosen as representative of the UT staff, but not because they are necessarily any different to their colleagues. If you visit our campuses you will meet many fine researchers and teachers, just like those in the sample we introduce here.

Hiroyuki Sakaki
Institute of Industrial Science

Tsugitaka Sato
Graduate School of Humanities and Sociology

Hiroshi Suzuki
Graduate School of Pharmaceutical Sciences

Tadatsugu Taniguchi
Graduate School of Medicine

The "Greedy Specialist" in Japanese History

Hideo Kuroda

Historiographical Institute

In his latest work, *Nihon Chusei Shoen Ezu no Kaishakugaku (Understanding Illustrations of Medieval Japanese Manorial Domains)*, published in July 2000, Professor Kuroda's research interests are described as "Japanese medieval and early modern history, the historiography of painting, historical cartography, and historical geography." This shows how broad are the interests of Professor Kuroda, who is actually a scholar of Japanese history. Let us hear his own description of how he came to be what he says a "greedy specialist."

My research stems from the history of medieval development. Postwar Japanese historical studies were dominated by theoretical research based on the view that history was a process of development. In that environment I conducted fieldwork using the methodology of historical geography, trying to draw an accurate historical picture. My study of *ta-asobi* (rituals in which the stages of rice growing are imitated by performers moving around a drum), an important historical record in itself which gives a broad picture of medieval folk movements, the history of agricultural technology and the history of folklore, was well received, because I was able to present a very different historical image to what had come before, deriving from the originality both of the subject and the methodology.

In 1972 I took up a post in the Historiographical Institute at the University of Tokyo and was put in charge of documents belonging to the formative years of the early modern period (seventeenth century). Stimulated by contacts with the foremost scholars in the field, I asked myself what was the exact nature of the way the country was divided administratively into provinces and rural districts and so began studying illustrated maps of the provinces.

My interest in historical cartography had already sprouted at that time. I then turned my attention to the possibilities inherent in illustrations as historical documents and grappled with the problem of the medieval status system as a test case which fully demonstrated what was possible. This is because status at that time was visible. By analyzing the illustrations I was able to grasp medieval popular consciousness in a vivid way, and I hope I was able thereby to contribute to a broader understanding of the period. It is not that the new genre of silent sources, of pictorial resources, had grown, but that the way they were used changed the way documentary and expressive sources were read. Their interrelationship may be said to have become the initial explosion which triggered a new way of dealing with historical documents.

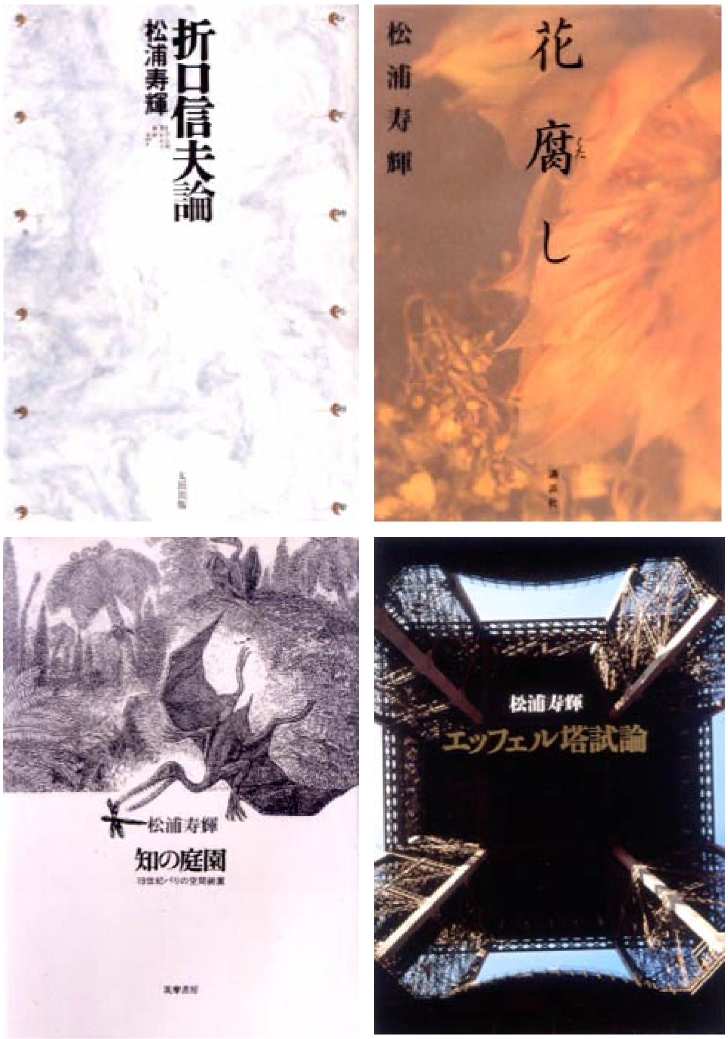
The Center for the Study of Pictographical Materials at the Historiographical Institute has three data bases which are now able to treat archival material and old documents as pictorial images. So we are not only reading historical documentary sources but looking at them through a pictorial image data base. No longer can we say that the only pictorial material that can be considered historical documentation is picture scrolls and other pictures.

My current research theme, about which I am very excited, is dragons. I want to consider the consciousness of medieval people about the land in terms of dragons. Beliefs concerning a dragon deity can be found in every region of Japan. Take dragon caves, for example. Dragons lived in them and they were all connected under the ground. I would suggest that medieval people thought of the land as being riddled with holes, which dragons passed between. There is also the belief that deep under the sea lay the palace of the Dragon King.

Dai-Nihon Jishin no Zu (a picture of dragon)

Website of Center for the Study of Pictographical Materials (http://www.hi.u-tokyo.ac.jp/gazo/gazo.html)

There are many legends about dragons. Medieval people thought that deities took the form of dragons to lead warriors to victory in war. They may have thought that dragons physically supported the land that was Japan and that Japan itself was at the same time the realm of giant dragons who passed to and fro within it and riddled the earth with holes. The *namazu-e* (catfish pictures) which appeared during the Tokugawa period (1600–1867) in connection with earthquakes, originated as pictures of dragons.



A variety of books written by Professor Matsuura

Multi-Headed Chimera

Hisaki Matsuura

Graduate School of Arts and Sciences

This summer a professor at the University of Tokyo featured widely in the media, from newspapers to television: Hisaki Matsuura, who teaches in the Department of Interdisciplinary Cultural Studies at the Graduate School of Arts and Sciences. The reason for his fame was that he won the 123rd Akutagawa Prize for his novel *Hana kutashi* ("Corrupt Blossoms"). The Akutagawa Prize is Japan's most prestigious literary award and in all its long history, Professor Matsuura is the first teacher from the University of Tokyo to have won it. This is not the first time, however, that Professor Matsuura has won an important prize. In fact it can almost be said that prizes have been well-deserved adjuncts to his distinguished academic career.

Professor Matsuura graduated from the well-known Tokyo secondary school, Kaisei School, in 1972 and entered the University of Tokyo. After graduating in 1976 he continued on to do his Master's degree in French literature as a graduate student in the Humanities. The same year he received a scholarship from the French government and went to study for a Master's in French literature at the University of Paris III. Having taken the degree, he returned to Japan to finish his graduate study. Then he returned to Paris and studied for his doctorate, which he attained in 1981. After his return to Japan in 1982 he worked as a research associate in the College of Arts and Sciences at the University of Tokyo, after that becoming a lecturer at the Tokyo University of Electronics and Communications. He returned to the University of Tokyo in 1991 as an associate professor in the Graduate School of Arts and Sciences, becoming a full professor in 1998.

Professor Matsuura should perhaps be called a modern Renaissance Man or rather a multi-headed chimera, for his research interests span French literature, modern Japanese poetry, and the history of film and cinematic theory, and the results of this research have appeared in a large number of books. In 1995 he received the Yoshida Hidekazu Prize from the Mito Arts Academy for his book *Efferuto Shiron (Writings on the Eiffel Tower)*, in 1996 the Mishima Yukio Prize for his *Orikuchi Shinobu Ron (A Study of Orikuchi Shinobu)* and the same year the Shibusawa Claudel Prize for his *Heimenron—1880 nendai Seio (Questions of Plane—Western Europe in the 1880s)*, and in 2000 the Minister of Education Prize for his *Chi no Teien (Gardens of Knowledge)*. Truly his research seems constantly to produce awards.

The professor is not involved only in graduate teaching but is also active in teaching undergraduates, including first and second year French, and a variety of other subjects. In particular, his research seminar on film is one of the most popular courses at Komaba and is attended by a great many undergraduates. His lectures follow the tradition of the present President of UT, Professor Shigehiko Hasumi, in their popularity.

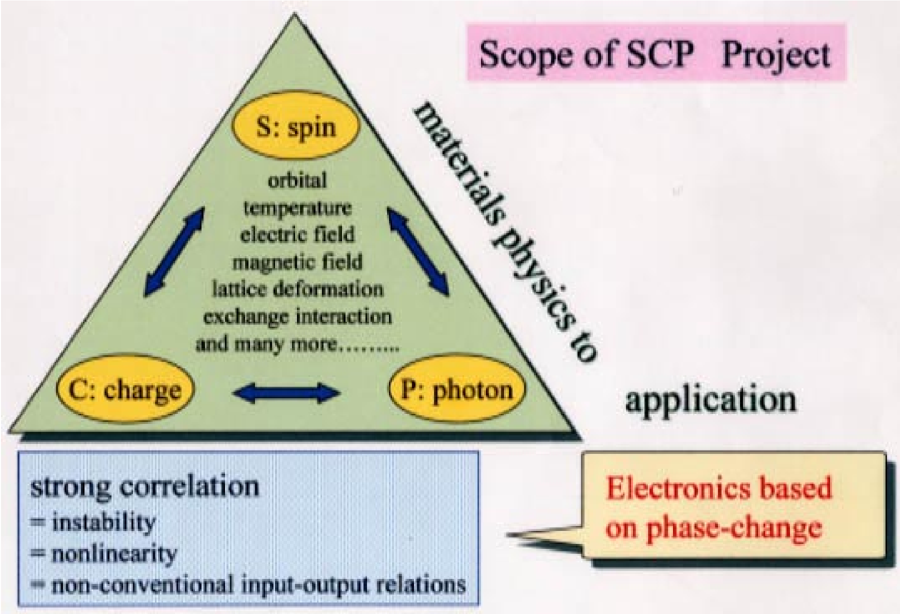
Perhaps it is in his creative life that his uniqueness becomes apparent. Since he was comparatively young he has been active as a poet, and published his first book of verse in 1982. He has won prizes for his poetry as well, having received the Takami Jun Prize for his collection *Fuyu no Hon (The Winter Book)* in 1983. In recent years his interest has shifted from poetry to novels and he made his debut as a novelist in 1996 with *Mono no Tawamure (The Jest of Things)*. Finally, with the award of the Akutagawa Prize in 2000 he has become a representative Japanese novelist in name as well as fact.

"All these awards just show how mediocre I am," he says somewhat cynically, "because I feel my works have too easily been accepted by the establishment. That is not necessarily my intention." His next challenge is to become a movie director, no less. "Of course I want to try my hand at film-making. But there are a lot of skills necessary and I don't think becoming a director is all that easy. And I certainly can't make a movie just by myself," he comments. Scholar, critic, poet, novelist— Professor Matsuura has many identities. Perhaps that of movie director is entirely in character.

Understanding Electron Movement

Kenjiro Miyano

Graduate School of Engineering



Professor Miyano, the leader of the Center of Excellence project of the Ministry of Education named "Phase Control of Spin-Charge-Photon Coupled Systems, also a JST (Japan Science and Technology Corporation) project, is an advanced researcher in the fields of light and properties of materials. He took his Ph.D. in 1974 in the Department of Physics at Northwestern University (USA). He then undertook research at University of California, Berkeley, Argonne National Laboratory, and the Collège de France. After working at Tohoku University as an associate professor, he is now professor of the Department of Applied Physics at the Graduate School of Engineering.

Recently he has been chiefly involved in research into so-called strongly-correlated electron systems. They represent a group of materials in which electrons are allowed to move through only certain narrow sites in the crystalline lattice in marked contrast to ordinary semiconductors or metals. Just like a crowd of people, tightly compacted electrons can move as a whole or not move at all, hence the name "strongly-correlated electrons." One fascinating example of electron movement as a whole is superconductivity in which the electric current can flow without dissipation. A sudden change of electron movement can be triggered by external stimuli and can be controlled. The project that he is leading (Phase Control of Spin-Charge-Photon Coupled Systems) aims to achieve this type of control, especially with light (photons).

"We have so far demonstrated a photo-induced conductor (a pulse of light turns an insulator into a conductor), a photo-induced insulator (the other way round), and an optical switch (a light pulse makes a transparent material opaque), to list a few," he says. "Although the materials have for years been known for their 'strange and often irreproducible behavior,' with powerful in-house theoretical help, we now have a fairly solid understanding of these phenomena in terms of 'orbital liquid-crystalline state;' the shape of the electron clouds can collectively move or fluctuate, making the electrons move or halt."

The next goal of the project is to make these phenomena happen under more moderate conditions: for example, with ordinary light, not laser light, and at ambient temperature, not cryogenic temperatures. "These results were totally unexpected at the beginning of the project," Professor Miyano added. He is sure that their findings will be the basis for a new paradigm in the electronics of tomorrow.

Close collaboration among members of the department with expertise in sample preparation, optical measurement and quantum theory is without doubt responsible for the success of the project. Professor Miyano also stresses that it is important for success to create an atmosphere where all members of the research team, junior and senior together, are treated equally and where their relationships can be borderless. "This is the only way that a project in materials science, which inherently consists of a collection of sub-fields, small-scale but of an immense variety, can make an impact," he stresses.

Professor Miyano's motto is "it's no use if you don't live life to the full." He constantly expresses his wish that all students do that. "I like wandering about my research laboratory," he says. He realizes the importance in an experiment of watching what is actually going on and is in sympathy with the sentiment, "Even if I knew I was going to die tomorrow, I would plant a tree today." Such an attitude typifies the philosophy of a teacher to whom it is important to nourish the next generation, and who leaves his students with a strong impression of his wide-ranging vision.

Bridging the Microscopic and Macroscopic Realms

Tomoko M. Nakanishi

Graduate School of Agricultural and Life Sciences

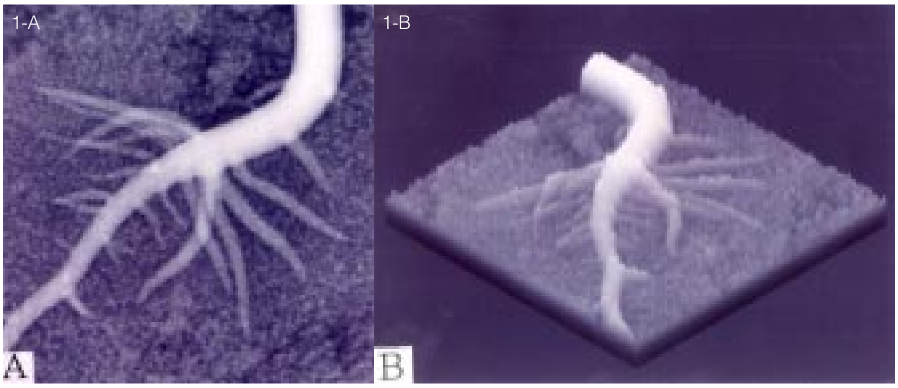
photo by Takashi Kakinuma

This year, Dr. Nakanishi received the Saruhashi Prize for the study, "Water and Trace Element Movement in a Plant." The prize is awarded yearly to one Japanese female scientist who has made an important contribution to the natural sciences. Let's listen to the explanation of her studies in her own voice.

Water movement plays an important role in biological activity. Though more than 80% of a living cell is water, water content in a cell gradually decreases with age; in other words, aging might be regarded as a water losing process. One of the most fascinating features of a plant is that it always consists of various stages of tissue, from meristem to old tissue. Thus there are in one plant all the stages from a baby to an old person. A baby requires a lot of water, but it is always losing it! One corn plant contains about 2 liters of water and absorbs more than a hundred times more water during its life cycle, which corresponds to about 280 mm of rainfall. Water in a plant is mainly lost from stomata. Though each stoma is fairly small, a few microns in size, one corn plant has about 200 million stomata, therefore about 1 to 2% of the plant surface is always exposed to air.

To understand biological activity in an intact plant, a nondestructive technique is extremely important. However, methods for such *in vivo* measurements have not been well developed. Since I have been performing activation analyses to measure elements using a research reactor, I have found that neutrons can be used to produce a water specific image in living plants. This technique provides the highest resolution for water in tissue yet obtainable. When I tried neutron radiography, the water images in flowers, seeds, and wood disks turned out to be very beautiful. They are all products of nature. I studied how seeds grow inside a pod, and how flower bulbs develop. All the same, my interest was always in the root. A plant is sometimes compared to a human being, standing upside down, with the head stuck in the soil, for the main sensory organs—the eye, the nose, the mouth, etc.—are all located in the root. I analyzed how roots develop, and absorb water from the soil. Besides two-dimensional images, I constructed spatial images of the roots imbedded in soil by piling up hundreds of CT images. From these three-dimensional images, the dynamic activity of living roots was studied for the first time. Besides the neutron study, I am now performing PETIS (positron emitting tracer imaging system) to measure real time water movement, in which 18F-labeled water is produced by a cyclotron, and then traced in the plant during water absorption.

Various elements are dissolved in water as signals; that is, water can be regarded as an important medium in the information transferring process. Therefore, I also



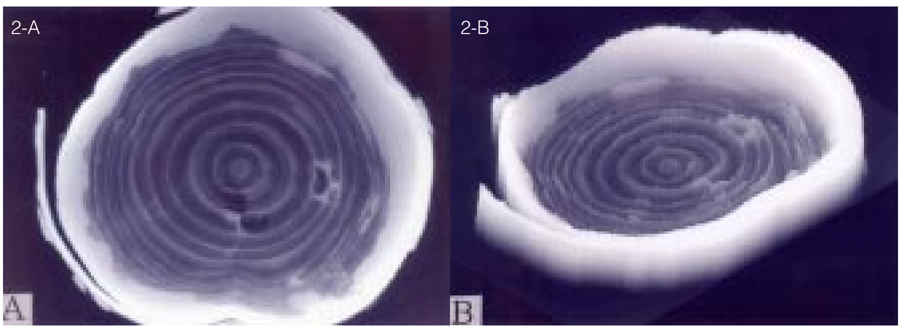


Fig. 1. Neutron image of a soybean root.
Neutron image of a soybean root imbedded in soil. Darkness in the picture corresponds to the degree of water deficiency (A). Three-dimensional image of A, where the height of the image corresponds to the relative water content, degree of lightness (B).

Fig. 2. Neutron image of a Japanese cypress (a 10 mm thick wood disk).
Darkness in the picture corresponds to the degree of water deficiency. An overwhelmingly great water distribution near the bark was observed. Water distribution near the bark was not parallel to the annual ring (A). Three-dimensional image of A, where the height of the image corresponds to the relative water content, degree of lightness (B).

Fig. 3. Water image of a lily.
Darkness in the picture corresponds to the degree of water deficiency. Water distribution in leaf, stem and flower petals are shown. Inside the flower pod the growth of another development can be observed.

analyzed the element concentration in every tissue of the plant throughout its life cycle. To my great surprise I found tremendous differences in element concentration in different tissues, and even in different locations within the same tissue. Sometimes, these concentrations change by an order of magnitude. This has made me curious to know if we can expect such differences in human beings, for example between an arm muscle and the foot. In plants, the gradient of each element was systematically spread out throughout the whole plant, and was further separated by junctions between different tissues. This gap also appears to vary for different elements, and in relation to environmental stress. The dynamics of elements in plant tissues also suggests that the plant itself is a great information processing center that may be comparable to a brain in a human being. How plants regulate their growth without a central nervous system remains a central question for me.

Although there has been a tremendous amount of work at the microscopic level, represented by gene technology, or macroscopic work, like field research, there has been relatively little study at the level of plant tissues, or whole plant systems. The intact plant itself has a high potential to integrate many functions and to respond to many diverse environmental conditions. Through nondestructive imaging of water *in vivo* and element movements, I would like to inaugurate a new field of plant research, not only to reveal new functions or evaluate intact systems, but also to find ways to bridge the microscopic world of living plants with that of the macroscopic world.

Taming the Winged Horse

Hiroyuki Sakaki
Institute of Industrial Science

At present, exploratory studies on nanostructures and quantized electrons tamed therein are being conducted by a number of researchers at the University of Tokyo, spanning such disciplines as physics, electronics and material sciences. To enhance cross-fertilization and intra-university collaboration, the networking of related research groups is strongly promoted by using the framework called Nano-Link. In addition, the Ministry of Education has recently decided to back this group research on quantum dots by providing a generous five-year grant through its Center of Excellence (COE) funding program. Professor Sakaki serves as the leader of this project. A recipient of the 1996 IEEE David Sarnoff Award and numerous prizes, he has recently received the Fujiwara Prize, which has a prestigious history of more than forty years in the Japanese scientific community.

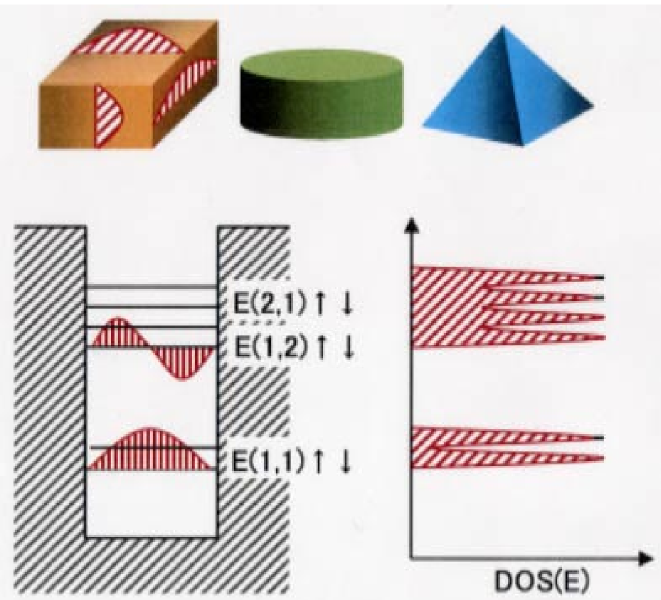
The impact of semiconductor electronics is immense. The advent of the internet, cellular phones, PCs and word processors as well as audio-visual apparatus, brought forth by advanced semiconductor technology, has altered not only modes of human communication but also the socio-economic framework of the world.

Along with these outcomes of innovation, another chain of exciting events has been going on at the frontier of semiconductor research. A key phrase here is “taming the winged horse of the electron” by leading the horse into the training ground of a semiconductor whose height, width and/or length are about 10 nano-meters (nm) or 10 billionths (10^{-9}) of a meter. In such nano-spaces, an electron follows the law of quantum mechanics and exhibits its wave nature, in contrast to the particle-like electron that moves freely in a wide open space just like a winged Pegasus in the sky. Professor Sakaki has played a pioneering role in this field over the last thirty years; he has designed and synthesized unique nano-structures and has shown that the taming of electron waves in such spaces enables not only drastic improvement in transistors and lasers, but also the creation of innovative devices that add new dimensions to electronics.

The quantum confinement of electrons is most easily achieved in ultrathin semiconductor sandwich structures, where electrons are bound in the 10 nm-scale middle layer. Lasers employed in fiber networks and CD pick-ups actually make use of such a sandwich, as light is generated efficiently when electrons are injected into the central layer. Such 10 nm-scale films are also used as the core part of high-speed transistors, key devices in LSI and advanced communication systems, since the stream of electrons can be switched on and off most efficiently in such films.

Moreover, 10 nm-scale films have opened the door to a set of new quantum devices. One example is an infrared detector invented by Professors Sakaki and Esaki. In this device, an electron in the film is reflected back and forth by the top and bottom surface of the film like the standing wave on a violin string vibrating at a specific frequency ν_1. When infrared light with a frequency ν_{IR} enters, this electron may absorb light (photon) to reach an excited state where $\nu_2 = \nu_1 + \nu_{IR}$. An excited electron wave of this type with a higher frequency (energy) flows out of the film and generates a detectable electric signal on the outside. This type of photo-detector, and also new lasers based on the reverse (inter-level transition) process, can detect and emit mid-infrared light of 4~20 μm in wavelength and so offer new possibilities in infrared imaging and molecular sensing, which play important roles in ecological monitoring and medical diagnosis.

The wave nature of electrons will be further enhanced if electrons are confined in 10 nm-scale wire- or box-like structures, since the particle-like motion of electrons is completely forbidden in such a box, being allowed only along one axis in a nano-wire. The use of these quantum wires and boxes (or dots) for the creation of new semiconductor devices has been proposed by Professor Sakaki since 1975. Despite early pessimism, a gradual effort has been made, and now unique methods of forming such wires and dots are being developed. For example, 10 nm-scale dots have become available by a self-organized growth scheme and are now widely employed to construct novel lasers, photo-detectors, and memory devices, where the attractive features of fully confined electrons are cleverly used.



Example of quantum dots (top) and a series of vibrating wave states (bottom left). Their density of states (DOS) or available seats are also shown (bottom right).

Untiring Pilgrim to Arabic Manuscripts

Tsugitaka Sato

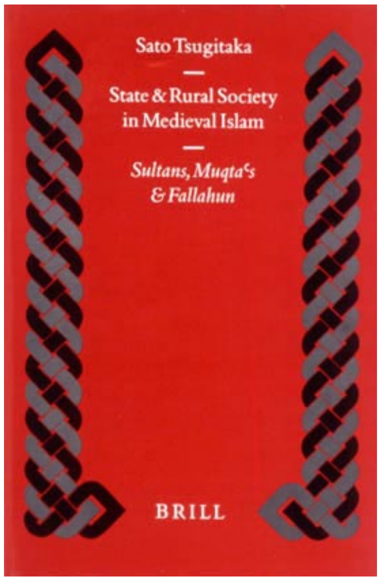
Graduate School of Humanities and Sociology

The study of the history of other countries takes much time and commitment. Scholars have to study perhaps a number of foreign languages, be able both to analyze and synthesize historical sources, and learn how to prepare material for scholarly discussion. Professor Tsugitaka Sato has gradually climbed this mountain and has reached the summit of his research into the history of the Islamic world.

Serious research into the history and culture of the Islamic world began in Japan in the 1970s following the “oil shock.” As well as being a comparatively young research field, it is one which has shown remarkable vigor and growth in recent years. Professor Tsugitaka Sato has for more than twenty years produced excellent results as a leader in Islamic studies in Japan. He specializes in the history of the pre-modern Arab world, especially the system of land organization called the *iqta‘* system in which he is a world authority. This year he was awarded prizes by the Japan Academy in recognition of his research activities, which include the publication (in English) of *State and Rural Society in Medieval Islam: Sultans, Muquta‘s and Fallahun* (Leiden, 1997). This work resulted from fifteen years of work in Europe and the Middle East investigating manuscripts and printed works. He travels to Damascus, Cairo and Istanbul on almost a yearly basis, visiting their libraries and archives to collect and decipher historical sources dealing with the *iqta*ʿ system. His study of that system clarified the relationship between state and society in the pre-modern Arab world and changes in that relationship. It is very gratifying that his painstaking basic research has been highly appreciated. Through his efforts, research in the field of Islamic studies by Japanese scholars has received attention in academic circles around the world.

Professor Sato is now closely involved with a large-scale, cooperative research project called "Islamic Area Studies," as its leader. This five-year project, which is supported by the Japanese Ministry of Education, began in 1997 and is now in its fourth year. More than forty scholars are working on the project, which has the aim of establishing a new framework for the understanding of the modern Islamic world and creating the research basis for Japanese Islamic studies. "Individual-based research is the mainstream in the West, but Japanese are very good at joint, cooperative studies. I would like to make the most of these merits," notes Professor Sato. "We are aiming to achieve a research style in Islamic studies that is neither Western nor that of Muslim scholars, but one that is particularly Japanese." The project's website (http://www.l.u-tokyo.ac.jp/IAS) gives notice of workshops, recruits foreign research fellows, and provides the latest information on research reports and other matters. A workshop chaired by Professor Sato was held in Oslo over the summer. In October 2001, he will organize another international conference entitled "The Dynamism of Muslim Societies: New Horizons in Islamic Area Studies." How energetic he is!

Professor Sato is straightforward in character. He delights, when he has the time, in going to pubs to drink with young students and debates long and loud with a glass in one hand. He is a formidable adversary, whether in terms of alcohol or in debate, yet one of the reasons that he has fostered a long line of excellent young scholars may be that his unexpectedly fierce out-of-class lessons are so effective!



Professor Sato's book on the history of *iqta*ʿ system.


A folio of Arabic manuscript held in the British Library.


Catalogue cabinet, Library of Süleimaniye, Istanbul.

Toward Safe and Efficient Drug Treatment

Hiroshi Suzuki

Graduate School of Pharmaceutical Sciences

Dr. Suzuki received his Ph.D. in 1989 from the Faculty of Pharmaceutical Sciences of the University of Tokyo. His major field is biopharmaceutics and pharmacokinetics. He is conducting research into the prediction from *in vitro* data of *in vivo* drug disposition, including interaction between drugs.

For several years, he has been focusing particularly on analyzing the mechanisms by which drugs are transported, since they are involved with the absorption, tissue distribution and elimination of drugs.

Since it has been shown recently that a series of carriers called ATP-binding cassette transmembrane (ABC) transporters contributes to drug excretion from cells, Dr. Suzuki has been analyzing the role of these transporters in drug disposition, and is now a leader in the field.

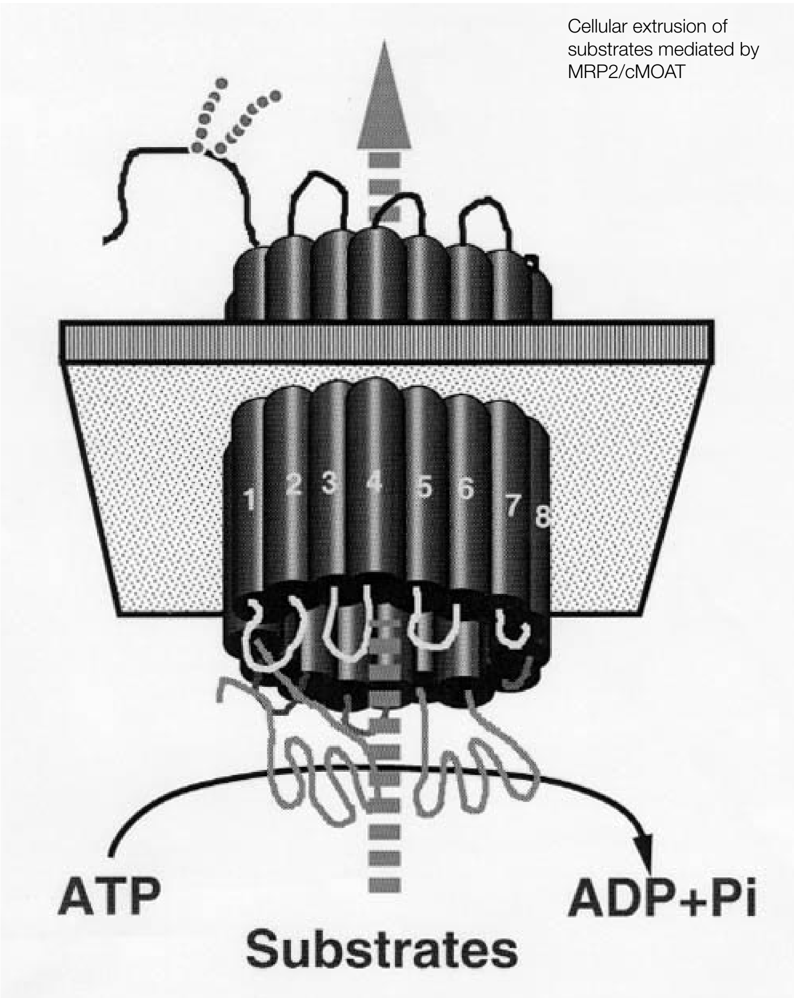
Although much remains unknown about biliary drug excretion, the discovery has been announced that a canalicular multi-specific organic anion transporter (cMOAT), an ABC transporter, is located on the bile canalicular membrane and that cMOAT transports a wide variety of organic anions including conjugated metabolites and clinically important drugs. cMOAT was cloned as a homologue of the multi-drug resistant associated protein (MRP1), another ABC transporter which can be found on the membrane of multi-drug resistant cancerous cells. cMOAT is composed of seventeen trans-membrane spanning domains and two ATP binding cassette regions. Due to a similarity of protein structure, cMOAT is also referred to as MRP2. The connection between protein structure and substrate recognition and transport is also becoming clearer through the introduction of site mutation. Since single nucleotide polymorphisms (SNPs) have also been found in healthy human volunteers, it is possible that genetic polymorphism may be a decisive factor in individual differences in the ability to excrete drugs. cMOAT/MRP2 deficiency is connected with the onset of the Dubin-Johnson syndrome in human beings.

It was found too that MRPs are made up of families of several kinds of protein. In fact, MRP3 was cloned as an inducible transporter on the basolateral membrane of hepatocytes under cholestatic conditions. Since MRP3 transports bile acids along with other MRP2 substrates, it is thought that MRP3 is responsible for the cellular extrusion of toxic endogenous compounds into the blood under pathological conditions. Further analysis showed that the brain endothenial cells and small intestinal epithelial cells have MRP activity, which restricts the movement of drugs to the brain and the intestinal absorption of their substrates respectively. It may be possible to modulate drug disposition by inhibiting the function of these efflux transporters.

Dr. Suzuki is currently studying the molecular cloning of *de no vo* MRP family proteins expressed in the blood-brain barrier, intestinal epithelium and cisplatin resistant tumor cells, and analyzing both the mechanisms for the inducing and intracellular sorting of transporters and the synergistic role of metabolic enzymes and efflux transporters. These studies, together with SNP analysis, are closely related to *de no vo* drug development and to the safe and efficient treatment of patients.

Dr. Suzuki gets much pleasure from educating students who are forward-looking and who enjoy responding to challenges. Since research to some extent reflects the character of the researcher, he feels it is important to extend his graduate students' individuality. His own interests include photography, classical music, opera and art.

Cellular extrusion of substrates mediated by MRP2/cMOAT



Front-runner in Cytokine Study

Tadatsugu Taniguchi

Graduate School of Medicine

Dr. Taniguchi has continued to be one of the front-runners in cytokine research at the molecular level for twenty years. Dr. Taniguchi and his colleagues have published literally dozens of papers in prestigious journals such as *Nature*, *Science* and *Cell*. Dr. Taniguchi has already received many awards, including the Hammer Prize, the Behring-Kitasato Prize, the Milstein Award, the Robert-Koch Prize, the Asahi Prize and the Japan Academy Prize.

Cytokines, a group of molecules that mediate cell-to-cell interactions, play a crucial role in virtually all aspects of biological activity. Some cytokines and their inhibitors have been introduced as treatment modalities against diseases such as cancer and rheumatoid arthritis. However, until twenty years ago, cytokines were considered to be 'factors' contained in the culture supernatants of unknown molecular characteristics, even by the investigators, and most cytokine research described phenomenological aspects.

After obtaining his Ph.D. degree in Molecular Biology at the University of Zurich, he started research on interferons, which have anti-cancer and anti-virus activities, in the Cancer Institute, Japanese Foundation for Cancer Research. He extensively introduced a molecular biological approach in the field of cytokine research, and succeeded in discovering the interferon β (IFN-β) gene in 1979, the first of many cytokine genes to be discovered afterwards. Subsequently, he also discovered the interleukin 2 (IL-2) gene, encoding the molecule critical for the proliferation of lymphocytes, and so a central regulator of the immune system. His researches led to a major breakthrough in cytokine research, making it possible to discuss the role of cytokines in various aspects of biological activities using the language of biochemistry.

In 1984, Dr. Taniguchi moved to Osaka University, where he and his colleagues made a number of important discoveries about intracellular signaling mechanisms, how IL-2 induces proliferation and the activation of T lymphocytes. They also identified two molecules that regulate the production and action of IFNs, IRF-1 and -2. These molecules have now been shown to be associated with a number of important biological aspects including cancer development, resistance to viral infection, and development of the adaptive immune system. In 1995, Dr. Taniguchi moved to the University of Tokyo, where he continued to work actively on the complexity of the networks on cytokine production and action.

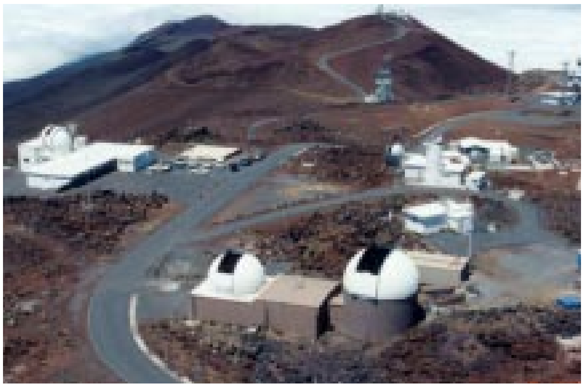
Dr. Taniguchi's personal history is unique. He was born in 1948 in a small village in Wakayama. Of all his classmates at elementary school, he was the only one that subsequently graduated from a university. At the age of 24, he joined the Laboratory of Biological Chemistry, the University of Naples in Italy, as a research fellow. There he was inspired by many scientists and artists (Mario del Monaco, Maurizio Pollini, etc.), and, not only did his life there lead him to learn Italian, but also led him to decide to devote his life to research. His friendships are not restricted to the scientific community; for example, he has been friends with Mr. Yo-Yo Ma since his stay at Harvard over twenty years ago. He is also an avid baseball fan, supporting the Hanshin Tigers.

Dr. Taniguchi's discoveries led to the clinical application of cytokines to a number of diseases including cancer, infectious diseases and autoimmune diseases. Nevertheless, he emphasizes that the basics of science are to discuss and to understand the true nature of a phenomenon. "What is required for us now is to establish science as a culture on an international basis," he says. "We have to appreciate the idea of growing a tree with a large trunk and deep, wide roots, and not a tree that produces fruits instantly. I am convinced that the establishment of an academic system with a long-range perspective will produce more fruitful rewards, as well as brilliant scientists in the next generation."

The human genome project will shortly reveal the entire DNA sequence of the human genome, opening a new era for biological science and making a strong impact on our society. What will be the role of life science after that? "I have a feeling," says Dr. Taniguchi, "that a new paradigm, or a framework of thought, to understand the 'complexity of life' is required. We have to communicate more with researchers in different fields, including social sciences and humanities, and to develop a new field of research, which may be called 'Integrative Bioscience'." This is in fact congruent with what is already being discussed worldwide these days.

Dr. Taniguchi also feels that it is very important that integrative bioscience be developed with emphasis on its full integration into society. How to move forward to this goal is something that we all must consider.

Professor T. Taniguchi with Professor K. Ishizuka, Professor T. Tada and young colleagues.



The MAGNUM Project

The Graduate School of Science conducts comprehensive research within basic fields of the natural sciences like physics, chemistry, biology and geology. From among the great number of deeply interesting projects that the school is carrying out, we have selected the Magnum Project to introduce here. This is a large-scale project which seeks to map the very limits of the universe.

MAGNUM is an acronym for Multi-color Active Galactic Nuclei Monitoring. With the cooperation of the University of Hawaii, the MAGNUM Project has installed a 2 m telescope on the 3055 m summit of Haleakala on the Hawaiian Island of Maui, where the atmosphere is clear and stable, providing good conditions for astronomical observations. The aim of the project is to determine redshift independent distances to galaxies throughout the visible volume of the universe by using long term measurements of the light emitted from active galactic nuclei in the ultraviolet, optical and near infrared wavelength bands. The MAGNUM telescope is instrumented with a multi-color imaging photometer (MIP) and a wide field camera (WFC), both newly developed for the MAGNUM Project. The MAGNUM telescope is a facility of the Research Center for the Early Universe, affiliated with the Graduate School of Science of the University of Tokyo, and is one of the largest telescopes in the world dedicated to monitoring observations.

Will the universe continue to expand forever, or will it contract at some stage? A central question remaining in the current theory of the universe is what will be the final condition of the present-day expansion. To answer this, it is necessary to accurately determine the distances to the remotest objects in the universe that we are able to observe. The MAGNUM Project is pioneering a completely new method for determining distances to remote active galaxies and quasi-stellar objects using their luminosity fluctuations.

A black hole in the center of an active galaxy or quasi-stellar object accretes the surrounding matter, emitting great energy. The disk of accreting matter in the central region is extremely hot, and any dust in this region evaporates. Outside this hot region, the dust is distributed in a concentric torus surrounding the central accretion disk.

Since the evaporation temperature of the dust is known to be about 1500K, the distance of dust torus from the nucleus is proportional to the square root of the absolute luminosity of the nucleus. X-rays, ultraviolet rays and optical radiation emitted from the hot nuclear region are absorbed by the dust, and infrared rays are emitted from the heated dust. When the nucleus changes in luminosity, after a delay in time corresponding to the distance between the nucleus and the dust torus, the infrared rays will change in luminosity. Thus, the time delay gives a measure of the absolute luminosity and, when combined with the observed brightness, gives the luminosity distance. The evidence of this effect can be seen in the existing observational data.

The MAGNUM Project will measure the time delay between fluctuations in the short wavelength light emitted by the hot nucleus, and the fluctuations in the long wavelength light emitted by the cooler dust, in order to determine the absolute luminosity, and thus, the distance, of many active galaxies and quasi-stellar objects. Over the next several years this project will carry out high precision monitoring observations with the aim of resolving the greatest mystery of modern cosmology, by discovering whether or not the expansion of the universe is eternal and if Einstein's cosmological constant truly exists.

North polar star trails at the MAGNUM Observatory on Haleakala, Maui. A 30 min exposure at f/2.8 using Fuji MS100/1000 film by T. Aoki, 22 July 2000.

Abroad in Komaba

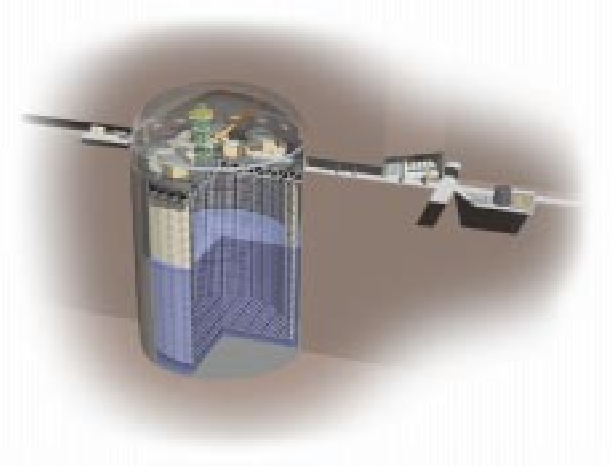
The Graduate School of Arts and Sciences (Komaba) undertakes interdisciplinary research and teaching which are not restricted by pre-existing structures, from area studies and comparative literature to multidisciplinary sciences and life sciences.

Students entering the University of Tokyo spend their first two years at the College of Arts and Sciences at Komaba in Meguro, one of the wards of Tokyo. The first year and a half consists of six units divided between the humanities and the sciences during which they study basic subjects, general subjects and then special subjects. In the final six months they continue the above, together with subjects from the faculty they wish to enter in the third year. The College of Arts and Sciences is not only in charge of the first two years of undergraduate education, but conducts programs spanning the humanities and the sciences at the third and fourth year level and post-graduate level (Graduate School of Arts and Sciences). More than 7000 students are registered for the general studies course covering the first two years (junior division), around 450 at the third and fourth year level (senior division) and 1200 at the postgraduate level. This makeup exemplifies the diversity of the Komaba Campus.

The college was set up in 1949 as part of the restructuring of the university after the Second World War. It has responded to changing needs and times since then by positively reforming its structure and curriculum until it has become what we see today. Its greatest feature is that its entire teaching staff is attached to the Graduate School of Arts and Sciences so that research results affect not only the third and fourth year courses, but the two-year general education course as well. The teaching and research of the graduate school offers a broad range of academic studies with an international perspective. Whereas the faculties based at the Hongo Campus are organized around a traditional framework, Komaba undertakes interdisciplinary research and teaching which are not restricted by pre-existing structures, from area studies and comparative literature to multi-disciplinary sciences and life sciences.

One program at Komaba which illustrates its concern with internationalism is AIKOM (Abroad in Komaba). This is a short-term (one-year) study-abroad and student exchange program which can be undertaken during the last two years of the undergraduate course. Seventeen universities in twelve countries are accredited and about twenty-five students are involved each year. The exchange is based upon mutual tuition wavers and credit transfer. Third and fourth year students from Komaba and its partner universities are the targets for the exchange. Exchange students (called AIKOM students) who have come to Komaba for the year have their own program, consisting of special courses taught in English, including special “relay” lectures and discussion seminars on Japanese culture and society, courses on specific topics, and regular courses in the Japanese language. There is also individual supervision to guide students who are writing research theses. All of these lectures, other than Japanese language and individual supervision, are open to students in the senior division of the college. AIKOM students too can, depending on their interests and Japanese ability, attend regular lectures in the senior division.

Foreign students at Komaba in general are on the increase. There were 395 on the campus as a whole as of May 1, 2000, and they are making a valuable contribution to the atmosphere of the College of Arts and Sciences with their youth and enthusiasm.



Super-Kamiokande Detector

Kamioka Observatory of the Institute for Cosmic Ray Research possesses the Super-Kamiokande detector, which is 1000m underground and utilizes 500,000 tonnes of ultra-pure water, mainly for observation of the “mystery” particle, the neutrino.

The Institute for Cosmic Ray Research conducts research into cosmology and particle physics through the observation of particles and rays such as protons, gamma rays, neutrinos and gravitational waves. Since such observation needs optimum conditions, it is undertaken in places like high plateaus and deserts, and also deep underground. The Institute’s Kamioka Observatory possesses the Super-Kamiokande detector, which is 1000 m underground and utilizes 500,000 tonnes of ultra-pure water, mainly for observation of the “mystery” particle, the neutrino. The experiments are conducted through a joint effort; involving are around seventy Japanese, including postgraduate students, about fifty Americans, and also some Koreans and Poles. The Institute for Cosmic Ray Research acts as the host institution.

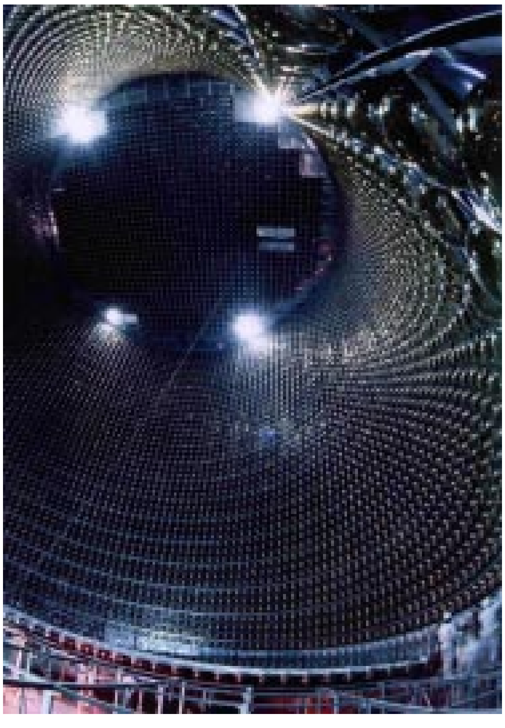
Observations began in April 1996. The phenomenon known as neutrino oscillation was apprehended for the first time, from a close observation of muon-neutrinos which cosmic rays make in the atmosphere. As a result, it was proved conclusively that though the mass of tau-neutrinos is minute, it is finite. In order to push forward with this research, an experiment was conducted whereby muon-neutrinos produced artificially by the High Energy Accelerator Research Organization, KEK at Tsukuba, were detected by the Super-Kamiokande detector 250 km away. This was the first time anywhere in the world that an experiment had been made sending particles such a long distance. The results of the observation of atmospheric neutrinos are already in the process of being verified.

Another important item of research is the close observation of electron-neutrinos made by nuclear reactions in the sun’s core. This is an attempt to resolve the long-standing solar neutrino problem (the number of electron-neutrinos observed coming from the sun is only about half the number converted from the sun’s heat energy).

Natural phenomena know no rest and so observation continues for twenty-four hours a day, 365 days a year. There are three shifts a day, with one or two people working each shift. Shifts must be worked if researchers want their names on the published results. There is no difference between research leaders and graduate students. Because of the international nature of the project, meetings and other communication are in English. This is difficult for the Japanese graduate students at first, but after about two years they get used to it. At the same time, as some of the Americans are fluent in Japanese, the Japanese cannot relax completely speaking their own language!

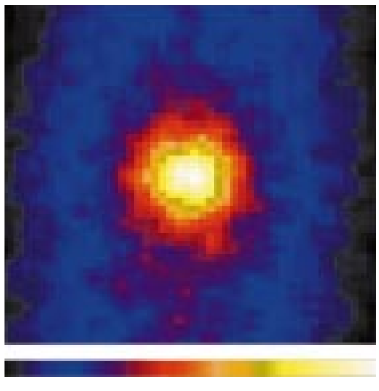
	1st generation	2nd generation	3rd generation
Leptons	electron electron-neutrino	muon muon-neutrino	tau tau-neutrino
Quarks	up quark down quark	charm quark strange quark	top quark bottom quark

A diagram of elemental particles. This corresponds with the periodic table of elements. The elemental particles can be grouped into four, while three groups exist based on differing mass alone. Matter is formed only from electrons, up quarks and down quarks, all in the first group. In the universe as a whole there should also exist a large quantity of electron-neutrinos, muon-neutrinos, and tau-neutrinos. It is not known why the universe requires three groups of elementary particles. Research into neutrinos may provide an answer to that mystery.



General outline of the Super-Kamiokande detector (above).
Interior section of the Super-Kamiokande detector.

A photo of the sun taken by neutrinos (computer image)



Toward New Research on Asia

The Institute of Oriental Culture will continue to strive to forward research into and education about Asia as a whole, as its research guidelines lay out, and endeavor to meet the demands that society makes of it.

This year, as we look toward the twenty-first century, the Institute of Oriental Culture celebrates its sixtieth year. It is one of the smaller institutes attached to the University of Tokyo, but it has produced many eminent scholars, including one who has been decorated with the Order of Culture, six Persons of Cultural Merit, and ten who have won Japan Academy Prizes. It is highly esteemed as Japan's only, and one of the world's few, such institutes, and conducts broad-based research into Asian politics, economics, society and culture. To commemorate its sixtieth anniversary, two publications are planned, a work for the general reader called *An Introduction to Asian Studies* and a book for specialists in the field entitled *The Future of Asian Studies*.

The institute, then consisting of three departments, was set up in 1941 with the purpose of conducting comprehensive research into oriental culture. It now consists of thirteen subdepartments organized into four broader departments based on research areas, Pan Asian Studies, East Asian Studies, South Asian Studies and West Asian Studies, and twenty-one research fields. In 1999 the existing Documentation Center for Asian Studies was closed down and replaced with the Research and Information Center for Asian Studies, made up of three subdepartments, focusing on documentation, formative materials and visiting fellows. The institute therefore now consists of four departments and one center.

The number of research publications alone attest to the academic vigor of the institute: 75 volumes in the Monograph Series of the Institute (MSIOC), 32 volumes of expedition reports, 89 volumes in the Asian Studies Documentation Series, 139 volumes in the Memoirs of the Institute Series, and 80 volumes of the journal, *Oriental Culture*. Besides the individual research reported in the Monograph Series, a total of 274 scholars from both within and outside the institute make up 47 research groups.

Reflecting the fact that the institute is a comprehensive research center, members of the staff come from six different faculties and assist five graduate schools in the university with lectures. The institute is conscious of its wide-ranging and positive role in postgraduate education, and also participates in the newly-established Interfaculty Initiative in Information Studies. The Research and Information Center for Asian Studies is continuing to survey, study, collect and publish both documentary and formative materials. For the past twenty years courses have been offered on Chinese books, as has librarian training.

The institute's logo is an abstract design based on the ancient Chinese style of writing the character which means "east." The whole represents the world; the blue arc on the right is Asia and the green arc on the left is the rest of the world; the vertical red straight line is the line of longitude, and the green one the line of latitude, or the horizon; and the center where they intersect, the heart of the logo, is the institute, as the center for global research on Asia.

The institute will continue to strive to forward research into and education about Asia as a whole, as its research guidelines lay out, and endeavor to meet the demands that society makes of it.

Some of the volumes published by the institute displayed in the Director's office of the institute. They total more than four hundred, and range from the most advanced research to reference works to aid research. They represent basic works in Asian Studies.

Among the modern and classical Chinese works in the institute's collection of more than 300,000 books, is an important Song dynasty printing of Sima Qian's Historical Records. It is over eight hundred years old. Catalogues include the Catalogue of Classical and Modern Chinese Books in the Institute of Oriental Culture, Classified Catalogue of Contemporary Chinese Books, and a database.

The logo mark is used with the institute's name and address in English and Japanese on the home page, as a letterhead and on airmail envelopes. It was designed by the well-known graphic designer Shigel Shimo'oka.

January

■The seventh general meeting of the AGS (Alliance for Global Sustainability) was held in Boston at MIT. Eighty members of UT, including President Shigehiko Hasumi and Vice-president Masahiko Kobayashi, took part in the meeting (see pages 10–13).

■UT Forum 2000 was held at MIT's Wong Auditorium on the 24th. Seven members of UT specializing in natural sciences talked on topics related to their areas of specialization. This event represents the first initiative of any Japanese university in holding such a self-introductory session outside of Japan. We will continue with this kind of effort to introduce ourselves abroad (see pages 6–9).

February

■The entrance examination for graduate students in the humanities was held.

■The first entrance examination for undergraduate students was held from the 25th to the 27th. This examination may be one of the most challenging for Japanese youngsters. The candidates, numbering 8464, who had already passed the first stage examination, competed for admission through the famously narrow gate, and just 2923 were admitted.

March

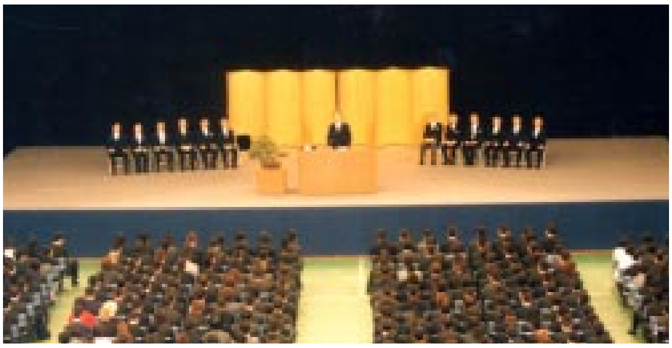
■The second entrance examination for undergraduate students took place on the 13th and 14th. Out of 1617 candidates, 351 were successful.

■Commencement for the academic year 1999 was held for 3368 undergraduate students on the 28th, and on the 29th the degree conferral ceremony was held for more than 3000 graduate students. In his congratulatory statement, President Hasumi advised the new graduates to remain flexible and open to change by making use of new encounters with others, while emphasizing that the "warranty" of any bachelor's degree is effective for just three or five years after graduation.

April

■Start of the new academic year.

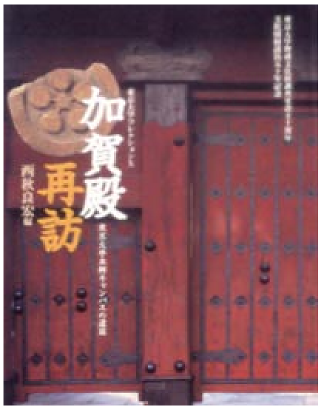
■The university's matriculation ceremony was held on the 12th. 3324 freshmen began their participation in the activities and campus life of UT. 2494 Japanese students and 186 foreign students were admitted to graduate school courses at the Master's level. 1193 Japanese students and 182 foreign students entered doctoral courses.



■Establishment of the Interfaculty Initiative in Information Studies and the Graduate School of Interdisciplinary Information Studies. This is the university's thirteenth graduate school.

May

■University Museum Exhibition: Revisiting Lord Kaga's Palace, Archaeological site at UT Hongo Campus (from May 20 till July 9). UT's Hongo Campus stands on a site that in the Edo period belonged to Kaga-han, one of the foremost feudal lords. Numerous historical artifacts have been discovered by the consecutive archaeological studies conducted on the site of the ancient palace.



■The 73rd Student May Festival was held from the 26th through the 28th at the Hongo Campus. About 57,000 people came to the campus to enjoy it.

■UT Emeritus Professor Masatoshi Koshiba, together with his American colleague, Professor R. Davis, was honored by being awarded the Wolf Prize for the year 2000. The prize was awarded in recognition of achievements in the field of physics.

July

■ Start of the summer holidays.

■ “Open Campus 2000” was held for the first time at the Hongo Campus. Nearly three hundred senior high school students, selected by lottery, came to the campus, listened to lectures given by two professors, and visited the main library, the university museum, and some historic buildings. This event provided the students with a good opportunity in which to learn about UT before making decisions about their futures.

August

■ The AEARU (Association of East Asian Research-oriented Universities) Students’ Summer Camp was held in Tokyo. UT is one of the founding members of this association, which is composed of seventeen universities. The main theme of the camp being “urban problems,” students visited Tokyo’s various urban facilities, attended lectures and energetically discussed the issues.

September

■ End of the summer vacation.

■ The entrance examination for graduate students in graduate schools in social sciences and in the natural sciences was held.

October

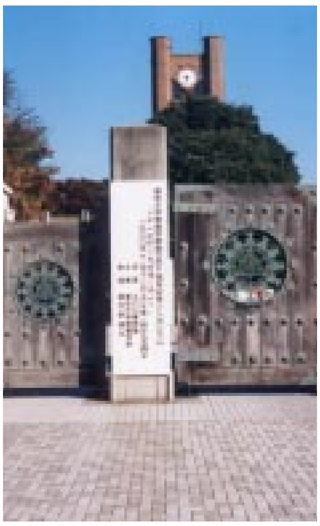
■ The Graduation Ceremony for foreign students learning Japanese at the International Center was held. Language courses at several levels are offered to introduce foreign students to the Japanese language and culture.

■ University Museum Exhibition: Von Siebold’s Collection of Japanese Plants. A series of associated events were also held to commemorate the 400th anniversary of the relationship between Japan and the Netherlands.

■ UT Symposium, “The 21st Century: How can the circulatory society be realized,” was held at Yayoi Auditorium.

November

■ Komaba Symposium: The Image of the University in the 21st Century.



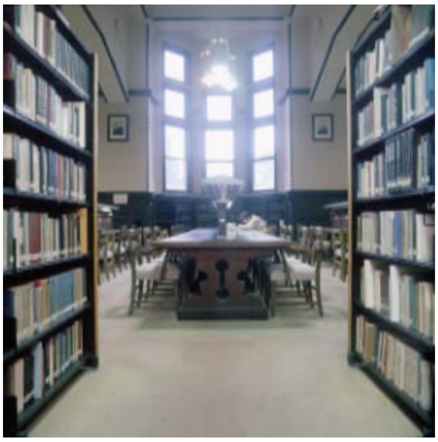
■ Symposium of the Graduate School of Interdisciplinary Information Studies: A Challenge for the Interfaculty Initiative.

■ Komaba Festival.

December

■ A series of special lectures given by Professor Susumu Tonegawa at MIT, a Nobel Prize winner, was held from the 4th to the 7th.

■ UT Forum 2000 in Silicon Valley and the Bay Area. A session on the Future of Life Science and Biomedical Research in Universities was held at Stanford University’s Fairchild Auditorium on the 15th.



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